REMARKS/ARGUMENTS

Claims 1-30 were pending in this application when the present Office Action was mailed. Claims 1, 4, 7-11, 17-19, 21, 22 and 27-30 have been cancelled. Claims 2, 3, 5, 6, 12, 13 and 20 have been amended to be in independent form. Accordingly, any rejection of these claims on new grounds should not be made final. Claims 31-47 have been added in this response. Accordingly, claims 2, 3, 5, 6, 11-16, 20, 23-26 and 31-47 are currently pending.

In the Office Action mailed December 20, 2002, claims 23-26 were allowed. Claims 1, 2, 10-13, 15-18 and 27-30 were rejected, and claims 3-9, 14 and 19-22 were objected to. More specifically, the status of the application in light of this Office Action is as follows:

(A) Claims 15 and 16 stand objected to as failing to provide proper antecedent basis;

(B) Claims 1, 13, 15-18 and 27-30 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,004,047 to Akimoto et al. ("Akimoto");

(C) Claim 2 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Akimoto in view of U.S. Patent No. 5,393,624 to Ushijima ("Ushijima");

(D) Claims 10-12 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Akimoto in view of U.S. Patent No. 5,363,171 to Mack ("Mack"); and

(E) Claims 23-26 were indicated to be allowable and claims 3-9, 14 and 19-22 were indicated to be allowable if rewritten to be in independent form.

A. Response to the Objection to Claims 15 and 16

Claims 15 and 16 were rejected as allegedly failing to provide the antecedent basis for the phrase "said first processing tool." This phrase is not included in either claim 15 or in claim 16. However, claim 13 has been amended to clarify that the tools referred to therein are processing tools. Accordingly, the objection to claims 15 and 16 should be withdrawn.

B. Response to the Section 102 Rejections of Claims 1, 13, 15-18 and 27-30

Claims 1 and 27-30 have been cancelled and accordingly the Section 102 rejection of these claims is now moot. The Section 102 rejection of claim 13 is discussed below.

1. The Invention

A method in accordance with one embodiment of the invention includes providing two processing tools, each of which is configured to process a microelectronic workpiece and apply material to the microelectronic workpiece. A microelectronic workpiece moves from one of the processing tools to an in-line metrology unit where a condition of a layer on the microelectronic workpiece is determined. In response to a signal from the metrology unit, a process parameter in the other processing tool is modified. An advantage of this arrangement is that multiple processing chambers can be coupled to a metrology unit so that information gained at the metrology unit from processes performed at one tool can be transmitted to the other tool to affect the processes conducted there. Accordingly, a different metrology station need not be provided for each processing tool. Claim 13 is directed to a method that includes these features and can achieve these advantages.

2. The Prior Art

Akimoto discloses a system 1 for processing photoresist on a wafer W. The system includes an adhesion processing unit 12, a cooling unit 13, and multiple heating units 15 arranged in a stack. A film thickness measuring instrument 18 is positioned atop the stack to measure the thickness of photoresist films on a wafer W carried by a transfer arm 3 that moves the wafers between the units. The photoresist film forming conditions are adjusted on the basis of the thickness measurement. An object of Akimoto's device is to "measure the thickness of a photoresist film on a substrate without taking the substrate, such as a wafer, out of the photoresist processing system." (Akimoto at column 2, lines 48-50).

3. Analysis

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described in a single prior art reference (MPEP at § 2131). The Section 102 rejection of claim 13 is not supported by Akimoto because, *inter alia*, Akimoto fails to disclose a method that includes "providing two processing tools," "moving [a] microelectronic workpiece from one of the processing tools to an in-line metrology unit," "using the in-line metrology unit to determine a condition of a layer on said microelectronic workpiece," and "modifying a process parameter in the respective other processing tool." In fact, by stating that an object of the invention is to "measure the thickness of a photoresist film on a substrate without taking the substrate, such as a wafer, out of the photoresist processing system," Akimoto expressly teaches away from the method of claim 13. Accordingly, the Section 102 rejection of claim 13 should be withdrawn.

Claims 14-16 depend from claim 13. Accordingly, these claims are patentable over the applied reference for the reasons discussed above and for the additional features of these dependent claims.

Claims 17 and 18 have been cancelled and accordingly, the Section 102 rejection of these claims is now moot.

C. Response to the Section 103 Rejection of Claim 2

Claim 2 was rejected under Section 103 as being unpatentable over Akimoto in view of Ushijima. Claim 2 has been rewritten to be in independent form.

1. The Invention

Another aspect of the invention is an apparatus that includes an in-line metrology unit for measuring a condition of a first layer on a microelectronic workpiece, a control that is signal-connected to the metrology unit, and a process unit that performs a material application process controlled by the control. A transfer unit is positioned to move the microelectronic workpiece among units of the apparatus, and

the condition signal from the metrology unit influences the process conducted at the process unit. Accordingly, the control can automatically apply results obtained at the metrology unit to adjust processes performed at the process unit. The control can also direct the microelectronic workpiece to a non-compliance unit, for example, when adjusting downstream processes will be insufficient to correct a non-compliant microelectronic workpiece. An advantage of this arrangement is that the noncompliant workpiece is diverted (e.g., for further processing or for scrapping) without significantly affecting the flow of other workpieces through the apparatus. Claim 2 is directed to an apparatus that includes these features and can achieve these benefits.

2. The Prior Art

Akimoto was described above. Ushijima discloses a process for coating a resist film on a wafer. Ushijima further discloses determining a thickness of the resist and, when the thickness is outside an allowable range, removing the resist from the wafer for rework, (Figure 10 and column 10 at lines 25-50).

3. Analysis

A *prima facie* case of obviousness under 35 U.S.C. § 103 requires that the prior art reference or references teach or suggest all the claim limitations, that there be some suggestion or motivation to modify or combine the reference teachings, and that there be a reasonable expectation of success (MPEP at § 2142). Akimoto, described above, fails to disclose or suggest a non-compliance unit. Ushijima fails to cure this deficiency of Akimoto. At best, Ushijima discloses removing a wafer having a resist layer that is outside an allowable range, but fails to disclose a non-compliance unit. Nor does Ushijima disclose or suggest, *inter alia*, "a control," signal connected to [a] metrology unit," wherein a "condition signal from the metrology unit influences said control to cause [a] transport unit to transfer the microelectronic workpiece to said non-compliance unit," as recited in claim 2. Accordingly, the applied references fail to support a *prima facie* case of obviousness under Section 103 and the Section 103 rejection of claim 2 should be withdrawn.

D. Response to the Section 103 Rejection of Claims 10-12

Claims 10 and 11 have been cancelled and accordingly, the Section 103 rejections of these claims are now moot. The Section 103 rejection of claim 12 (which has been amended, *inter alia*, to be in independent form) is discussed below.

1. The Invention

An apparatus in accordance with another embodiment of the invention includes an in-line metrology unit configured to measure a pattern dimension of a developed photoresist layer on a microelectronic workpiece. A control is signal-connected to the metrology unit. The apparatus further includes a process unit configured to perform at least one of a photoresist develop process and a photoresist application process that is controlled by the control. Accordingly, the measurements performed at the metrology unit (which represent a pattern dimension of the photoresist layer) influence a photoresist develop process or photoresist application process performed at the process unit. An advantage of this arrangement is that pattern dimension data received from a given microelectronic workpiece can influence subsequent photoresist application and/or development processes to improve the results of these processes and therefore the throughput of microelectronic workpieces. Claim 12, as amended, is directed to an apparatus that includes the foregoing features and can accordingly achieve the foregoing benefits.

2. The Prior Art

Akimoto was described above. Mack discloses a system 100 having a transmission detector 105 and a reflectance detector 106 positioned to measure characteristics of a photoresist-coated substrate 104. The detectors 105 and 106 are coupled to electronics 107 to provide a closed loop feedback arrangement for exposing applied photoresist. Accordingly, the apparatus can "[control] the exposure energy delivered into photoresist by an exposure tool in response to in-situ measurements of photoresist and reflectivity optical properties" (Mack at column 6, lines 39-41).

3. Analysis

As discussed above, a *prima facie* case of obviousness under 35 U.S.C. § 103 requires that the prior art reference or references teach or suggest all the claim limitations, that there be some suggestion or motivation to modify the referenced teachings, and that there be a reasonable expectation of success. The applied references fail to support a *prima facie* case of obviousness with regard to claim 12 because, *inter alia*, neither reference discloses or suggests an in-line metrology unit that measures a condition of a photoresist layer of a microelectronic workpiece, with the condition "including a pattern dimension of the photoresist layer." Furthermore, neither reference discloses or suggests coupling the metrology unit to a process unit to influence "at least one of a photoresist develop process and a photoresist application process" based on a condition signal representative of "a pattern dimension of the photoresist layer." At best, Akimoto discloses measuring the thickness of a photoresist film and Mack discloses measuring the exposure characteristics of the film, but neither reference discloses or suggests measuring the pattern dimension of the film and then influencing subsequent processes based on the measurement. Therefore, the Section 103 rejection of claim 12 should be withdrawn.

E. Response to the Indication of Allowable Subject Matter

Claims 23-26 were indicated to be allowable and have not been amended. Claims 3, 5, 6 and 20 were indicated to be allowable if rewritten in independent form. These claims have been so amended. Accordingly, these claims are now in condition for allowance.

F. New Claims 34-47 are Patentable Over the Applied References

New claims 31-47 have been added to the application in this response. Independent claims 31 and 36 include features generally similar to those indicated in the Office Action to be allowable. Independent claim 47 is directed to an apparatus that includes a seed layer tool, an electrochemical deposition tool, and a chemical mechanical polishing tool, each having a metrology station. A controller is operatively coupled among the metrology stations to influence a process performed at at least one

of the tools. None of the applied references appear to disclose or suggest such an arrangement. Accordingly, claim 47 patentably distinguishes over the applied references and should be allowed.

G. Conclusion

In view of the foregoing, all the claims pending in the application patentably define over the prior art. A Notice of Allowance is, therefore, respectfully requested. If the Examiner has any questions or believes a telephone conference would expedite prosecution of this application, the Examiner is encouraged to call John Wechkin at (206) 287-3258.

Respectfully submitted,
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Date: April 21, 2003

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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims:

2. (Amended) ~~The apparatus according to claim 1,~~A processing apparatus for processing a microelectronic workpiece, comprising:

~~further comprising~~ an in-line metrology unit having a space for receiving a microelectronic workpiece for measuring a condition of a first layer on said microelectronic workpiece and generating a condition signal;

a control, signal-connected to said metrology unit;

a process unit providing a space to receive said microelectronic workpiece and perform a material application process that is controlled by said control;

wherein said condition signal from said metrology unit to said control influences said process;

a non-compliance unit~~,~~; and

a transport unit positioned to receive the microelectronic workpiece from at least one of the process unit and the in-line metrology unit and move the microelectronic workpiece to the other of the process unit and the in-line metrology unit, ~~and a microelectronic workpiece transport signal-connected to said control,~~ wherein said condition signal from the metrology unit influences said control to cause said ~~microelectronic workpiece~~ transport unit to transfer the microelectronic workpiece to said non-compliance unit.

3. (Amended) ~~The apparatus according to claim 1, wherein said first layer comprises a seed layer, and~~A processing apparatus for processing a microelectronic workpiece, comprising:

an in-line metrology unit having a space for receiving a microelectronic workpiece for measuring a condition of a first layer on said

microelectronic workpiece and generating a condition signal, the first layer including a seed layer;

a control, signal-connected to said metrology unit;

a process unit providing a space to receive said microelectronic workpiece and perform a material application process that is controlled by said control;

wherein said condition signal from said metrology unit to said control influences said process;

~~further comprising~~ a seed layer enhancement unit~~,~~; and

a transport unit positioned to receive the microelectronic workpiece from at least one of the process unit and the in-line metrology unit and move the microelectronic workpiece to the other of the process unit and the in-line metrology unit ~~a microelectronic workpiece transport signal connected to said control~~, wherein said condition signal from said metrology unit influences said control to cause said ~~microelectronic workpiece~~ transport unit to transport ~~a~~ the microelectronic workpiece to said seed layer enhancement unit.

5. (Amended) ~~The apparatus according to claim 4,~~A processing apparatus for processing a microelectronic workpiece, comprising:

an in-line metrology unit having a space for receiving a microelectronic workpiece for measuring a condition of a first layer on said microelectronic workpiece and generating a condition signal;

a control, signal-connected to said metrology unit;

a process unit providing a space to receive said microelectronic workpiece and performing a material application process that is controlled by said control, the process unit including an electroplating reactor having at least one anode and a workpiece holder to hold said microelectronic workpiece as cathode;

wherein said process is dependent on the current between said anode and said cathode, said condition signal from said metrology unit to said control influencing said process, said control adjusting said current in response

to said condition signal, and wherein said condition signal is representative of a thickness of a seed layer applied onto said microelectronic workpiece; and

a transport unit positioned to receive the microelectronic workpiece from at least one of the process unit and the in-line metrology unit and move the microelectronic workpiece to the other of the process unit and the in-line metrology unit.

6. (Amended) ~~The apparatus according to claim 4~~A processing apparatus for processing a microelectronic workpiece, comprising:

an in-line metrology unit having a space for receiving a microelectronic workpiece for measuring a condition of a first layer on said microelectronic workpiece and generating a condition signal;

a control, signal-connected to said metrology unit;

a process unit providing a space to receive said microelectronic workpiece and perform a material application process that is controlled by said control, the process unit including an~~, wherein said~~ electroplating reactor ~~comprises~~having a plurality of anodes and a workpiece holder to hold said microelectronic workpiece as cathode; and

wherein said process is dependent on the current between said anodes and said cathode, said condition signal from said metrology unit to said control influencing said process, said control adjusting said current in response to said condition signal, and wherein ~~and~~ said control adjust~~ing~~ current between each anode and said cathode.

12. (Amended) ~~The apparatus according to claim 1~~A processing apparatus for processing a microelectronic workpiece, comprising:

an in-line metrology unit having a space for receiving a microelectronic workpiece for measuring a condition of a first layer on said microelectronic workpiece and generating a condition signal, the first

layer including a photoresist layer just after develop, the condition including a pattern dimension of the photoresist layer;

a control, signal-connected to said metrology unit; and

a process unit providing a space to receive said microelectronic workpiece and perform at least one of a photoresist develop process and a photoresist application process, the at least one process being controlled by said control~~, wherein said process unit comprises a photoresist exposure tool, and said first layer comprises a photoresist layer on said workpiece just after develop by a subsequent develop tool, and said condition to be measured is the pattern dimension~~.

13. (Amended) A method of processing a microelectronic workpiece, comprising the steps of:

providing two processing tools each of which further processes a microelectronic workpiece in a preselected process and is configured to apply material to the microelectronic workpiece;

moving the microelectronic workpiece from one of the processing tools to an in-line metrology unit;

using the in-line metrology unit, determining a condition of a layer on said microelectronic workpiece; and

in response to a signal from the metrology unit, modifying a process parameter in the respective other processing tool.

20. (Amended) ~~The apparatus according to claim 17, wherein said~~A processing apparatus for processing a microelectronic workpiece, comprising:

an in-line metrology unit having a space for receiving a microelectronic workpiece and configured to generate condition data in response to a measured condition on said microelectronic workpiece, the measured condition ~~comprises~~ including a seed layer thickness;

a processing unit providing a space to receive a microelectronic workpiece to apply material to said microelectronic workpiece;

a control, signal-connected to said metrology unit and to said processing unit to control said process of said microelectronic workpiece depending on said condition data; and

a transport unit positioned to receive the microelectronic workpiece from at least one of the process unit and the in-line metrology unit and move the microelectronic workpiece to the other of the process unit and the in-line metrology unit.